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For: DISK DRIVE DEVICE

Honorable Commissioner of Patents
Alexandria, VA 22313-1450

VERIFIED TRANSLATION OF PRIORITY DOCUMENTS

Sir:

Submitted herewith are copies of the Verified Translation of Priority Documents for Japanese Application Numbers Hei. 2000-123265 and Hei. 2000-123264 both filed on April 24, 2000, upon which application the claim for priority is based.

Respectfully submitted,

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DECLARATION

I, Shigetomo UMITSU of FUJIMURA & ASSOCIATES, do hereby solemnly and sincerely declare:

1. That I am well acquainted with the Japanese and English Languages, and
2. That the attached document
   Patent Specification entitled
   "RECORDING AND REPRODUCING DEVICE"
   is a true translation into the English language.

AND I MAKE THIS SOLEMN DECLARATION conscientiously believing the same to be true and correct.

Tokyo, February 20, 2004

Shigetomo UMITSU
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This is to certify that the annexed is a true copy of the following application as filed with this Office.

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Applicant(s): Pioneer Corporation

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Commissioner, Patent Office
Kouzou OIKAWA (Seal)
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[Name of Document] Specification 1

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[Document Name] SPECIFICATION
[Title of the Invention]

RECORDING AND REPRODUCING DEVICE

[Scope of claim for Patent]

[Claim 1] A recording and reproducing device driven and controlled by a power supply voltage in a vehicle, comprising an engine start detecting means for detecting an engine start of said vehicle, wherein said recording and reproducing device is driven after an engine start of said vehicle has been detected by said engine start detecting means.

[Claim 2] A recording and reproducing device driven and controlled by a power supply voltage in a vehicle, comprising:

a head for reading and/or writing information from and/or to an information recording medium loaded in said recording and reproducing device;

a head driving means for giving a driving instruction to said head;

an engine start detecting means for detecting an engine start of said vehicle; and

a head movement allowing means for allowing the head to be moved by said head driving means after an engine start of the vehicle has been detected by said engine start detecting means.

[Claim 3] A recording and reproducing device as recited in claim 2, further comprising a forcible moving part for forcibly moving said head to a retreat position when the power supply voltage in said vehicle is interrupted.

[Claim 4] A recording and reproducing device as recited in claim 3, wherein

said forcible moving means forcibly moves said head to the retreat position by providing said head driving means with counter electromotive force generated by the inertial rotation of a spindle motor driving said recording means to rotate.

[Claim 5] A recording and reproducing device as recited in any one of claims 1 to 4, further comprising a voltage value monitoring circuit for monitoring voltage values on a first power supply line provided with a normal power supply and a second power supply line provided with a power supply when an engine key is inserted and turned from a first position to a second position,

said engine start detecting means outputting an engine start detection signal when the voltage value on said second power supply line reaches a prescribed value, and then the value on the first power supply line or the values on the

first power supply line and the second power supply line become lower than said prescribed value and then higher than said prescribed value, based on an output value from said voltage value monitoring circuit.

[Claim 6] A recording and reproducing device as recited in any one of claims 1 to 4, further comprising a voltage value monitoring circuit for monitoring a voltage value on a third power supply line provided with a power supply when an engine key is turned from said second position to a third position, and a voltage value on a fourth power supply line provided with a power supply when the engine key is turned from said third position to a fourth position,

said engine start detecting means outputting an engine start detection signal when the voltage value on said second power supply line or said third power supply line reaches a prescribed value, and then the voltage value on said first power supply line or the voltage values on said first power supply line and said second power supply line become lower than said prescribed value and then higher than said prescribed value, based on an output value from said voltage value monitoring circuit.

[Claim 7] A recording and reproducing device as recited in any one of claims 1 to 4, wherein

said engine start detecting means outputs a signal which becomes validated by sensing an output of an engine tachometer.

[Claim 8] A recording and reproducing device as recited in any one of claims 1 to 4, wherein

said engine start detecting means outputs a signal which becomes validated by sensing vibration of the engine inside and outside the vehicle.

[Claim 9] A recording and reproducing device as recited in any one of claims 1 to 4, wherein

said engine start detecting means outputs a signal which becomes validated by sensing an engine sound.

[Claim 10] A recording and reproducing device as recited in any one of claims 1 to 4, wherein

said engine start detecting means outputs a signal which becomes validated by sensing traveling of the vehicle based on a vehicle speed pulse.

[Claim 11] A recording and reproducing device as recited in any one of claims 1 to 4, wherein

said engine start detecting means outputs a signal which becomes validated by sensing traveling of the vehicle using a

gyro sensor.

[Claim 12] A recording and reproducing device as recited in any one of claims 1 to 4, wherein

said engine start detecting means outputs a signal which becomes validated by sensing an operation position of a parking brake.

[Claim 13] A recording and reproducing device as recited in any one of claims 1 to 4, wherein

said engine start detecting means outputs a signal which becomes validated by sensing operation of a generator in the vehicle.

[Claim 14] A recording and reproducing device as recited in any one of claims 1 to 4, wherein

said engine start detecting means outputs a signal which becomes validated by sensing activation of a starter-motor.

[Claim 15] A recording and reproducing device as recited any one of claims 10 to 14, wherein

information on a previous OFF state of the engine is backed up in a memory, and said information is displayed on a screen in response to detection of a power supply being provided to said second power supply line.

[Detailed Description of the Invention]

[Technical Field to which the Invention pertains]

The present invention relates to a recording and reproducing device, and particularly to a recording and reproducing device for mounting in a vehicle, which is suited for coping with an instantaneous rupturing at the engine start time.

[Prior Art]

Hard disk devices (HDD) have widely spread as an external storage device for a personal computer. Meanwhile, the HDD has been reduced in price as the recording density has increased, and today, some home electric appliances have an internal HDD. The HDD can store a considerable amount of video and music contents and various products with an HDD are on the way to the market. Car audio equipment is a prospective item to be provided with an HDD. Car navigation systems mainly use DVDs as the storage, while the use of HDD is expected in the future.

The basic construction of an HDD is shown in Fig. 7. Depicted here is a ramp loading type HDD in which a magnetic head 51 provided at a tip end of an actuator 54 is mechanically raised from the magnetic disk surface to float.

As shown, the magnetic head 51 attached to the actuator 54 is provided movably in the radial direction (denoted by the arrow) of the magnetic disk 53, and the magnetic head 51 is pressed against the surface of the magnetic disk 53 by the elasticity of a suspension 57. Meanwhile, the rotation of the magnetic disk 53 controls the distance between the disk surface of magnetic disk 53 and the magnetic head 51 to be several tens μm by the aerodynamic floatation acting upon the magnetic head 51. In an inactive state, the magnetic head 51 is positioned at a retreat position where the head 51 is placed over the tapered portion 56 of a ramp 55 formed at one end of a casing frame 50.

The positional relation between the magnetic head 51 and the ramp 55 is shown in a sectional view in Fig. 8. As shown, the ramp 55 positioned in the vicinity of the outer circumference of the magnetic disk 53 has the tapered portion 56 which gradually away from the surface of the magnetic disk 56, outward from the outside peripheral portion. The magnetic head 51 is positioned (location a) to produce a prescribed distance on the the magnetic disk 53 at the time of reading/writing information from/to the magnetic disk 53 (at the operating time). In an inactive state (unloaded state), the head is placed over the said tapered portion 56 as denoted by the arrow in the figure, stands by at a retreat position (position b).

[Problem to be solved by the Invention]

Incidentally, the above described HDD has a function called emergency unloading. The emergency unloading function is to forcibly move the head to the retreat position in order to prevent the magnetic disk 53 from being damaged by the head when both of the power supply voltages to a spindle 52 and a motor for driving the magnetic head 51 fall down. A power supply is necessary to carry out this emergency unloading function. Meanwhile, it is known that counter electromotive force generated by the inertial rotation of the spindle motor 52 is used to perform the operation when the power supplies are both down as described above.

When the HDD described above is applied for mounting in the vehicle such as in a car audio product or a car navigation system, as the so-called instantaneous rupturing may occur at the engine start time, it is highly possible that the above described emergency unloading operation is performed each time the engine is started.

Fig. 9 shows a power supply line of a vehicle mounted audio product. As shown in Fig. 9, a backup power supply (normal power supply) line to which power is normally supplied and an accessory (ACC) power supply line which supplies a power source interlocking with a key switch are connected to the vehicle mounted audio product.

The manner of power supply, at the start of the engine, of the vehicle mounted power supply circuit to which the electric power is supplied via both of the power supply lines is shown in the form of a timing chart in Fig. 10. In this figure, (a) shows how the normal power supply voltage changes, (b) shows the manner of the power supply of ACC. The timings (I), (II), (III) and (IV) shown in the figure correspond to positions of the key switch of the engine key. In the timing (I), the engine key is at the "ACC position" where power is supplied to an audio product, for example. The timing (II) shows a case where, the engine key is at the "ON position" where power is supplied to a power window, for example. The timing (III) shows a case where, the key switch is in the "ST position" where power is supplied to the engine. The timing (IV) shows the case where the engine has started and the engine key is again returned to the "ON position."

During the operation as described above, there is a case in which, at the start of the engine, the voltage in the audio product's side drops (instantaneous rupturing) by the power supply voltage being used to start the engine (during the period from (III) to (IV) in Fig. 10).

Like this, if the HDD described above is applied for in-vehicle use, there is a possibility of occurrence of the instantaneous rupturing at the start of the engine, and it is likely to cause the above described emergency unloading every time the engine is started. In the emergency unloading operation, the counter electromotive force of a spindle motor is used to force the head to move. Therefore, in products for vehicles, the magnetic head 51 more often collides with the tapered portion 56 of the ramp 55 before the head 51 reaches the stand-by position b of the ramp 55 than the case of other kinds of products such as personal computers. More specifically, so far as the use in a vehicle, durability against collision must be considered since the possibility of the occurrence of the instantaneous rupturing increases each time of the engine start-up.

The present invention has been made in view of the circumstances described above, and it is an object of the present invention to provide an information recording and reproducing device for use in a vehicle in which, in an HDD for vehicle, the occurrence of an emergency unloading at the start of the engine is prevented by performing the drive of the HDD or the drive of the floating head slider 51 after detecting an engine start, to prolong the life of the floating head slider and to realize the improvement of the reliability as an HDD.

[Measure taken to solve the problem]

In order to achieve the above described objects, the present invention recited in claim 1 pertains to a recording

and reproducing device driven and controlled by a power supply voltage in a vehicle, said apparatus including an engine start detecting means for detecting an engine start of the vehicle, and the information recording and reproducing apparats is driven and controlled after an engine start of the vehicle is detected by the engine start detecting means.

With this feature, emergency unloading at the start of the engine can be prevented, and the number of collisions between the head and the ramp is reduced by the reduction in number of occurrence of the emergency unloading. As a result, the head may have a prolonged life and improved reliability as an HDD is achieved.

The present invention recited in claim 2 pertains to a recording and reproducing device driven and controlled by a vehicle power supply voltage, and the apparatus is provided with a head for reading/writing information from/to the information disk, a head driving means for giving a driving instruction to the head, an engine start detecting means for detecting an engine start of the vehicle, and a head movement allowing means for allowing the head to be moved by the head driving means after an engine start of the vehicle is detected by the engine start detecting means.

With this feature, the HDD becomes accessible after the engine is activated, and therefore emergency unloading occurrence at the start of the engine can be prevented. The reduction in emergency unloading occurrence reduces the number of collisions between the head and the ramp, so that the head may have a prolonged life and the disk drive may achieve improved reliability as an HDD.

The present invention recited in claim 3 is, in the recording and reproducing device recited in claim 1 or claim 2, further provided with a forcible moving means for forcibly moving the head to a retreat position when the power supply voltage in the vehicle is interrupted.

The present invention recited in claim 4 features, in the in-vehicle information recording and reproducing device as recited in claim 3, that the forcible moving means forcibly moves the head to the retreat position by providing the head driving means with counter electromotive force generated by the inertial rotation of a spindle motor driving the recording medium to rotate. Thus, the head can surely be returned to the retreat position if the power supply is interrupted, so that the HDD including the head can be prevented from being critically damaged.

The present invention recited in claim 5 is, in the recording and reproducing device recited in any one of the claims 1 to 4, further provided with, a voltage value monitoring circuit for monitoring voltage values on a first power supply line provided with a normal power supply and a second power supply line provided with a power supply when an

engine key is inserted and turned from a first position to a second position. The engine start detecting means outputs an engine start detection signal when output values from the voltage value monitoring circuit are such that the voltage value on the second power supply line reaches a prescribed value, and then the value on the first power supply line or the values on the first power supply line and the second power supply line become lower than the prescribed value and then higher than the prescribed value.

With this feature, the start of the engine can be detected by monitoring the voltages, and therefore the HDD may be activated or the head is allowed to move after the detection. As a result, emergency unloading can be prevented at the start of the engine, and the reduction in emergency unloading occurrence reduces the number of collisions between the head and the ramp, so that the head may have a prolonged life and the disk drive device may have improved reliability as an HDD.

The present invention recited in claim 6 is, in the recording and reproducing device recited in any one of the claims 1 to 4, further provided with a voltage value monitoring circuit for monitoring a voltage value on a third power supply line provided with a power supply when an engine key is turned from a second position to a third position, and a voltage value on a fourth power supply line provided with a power supply when the engine key is turned from the third position to a fourth position. The engine start detecting means outputs an engine start detection signal when the voltage value on the second power supply line or the third power supply line reaches a prescribed value, and then the value on the first power supply line or the values on the first power supply line and the second power supply line become lower than the prescribed value and then higher than the prescribed value, based on an output value from the voltage value monitoring circuit.

With this feature, the start of engine can be detected by monitoring the voltages, and the HDD may be activated or the head is allowed to move after the detection. As a result, emergency unloading at the start of the engine can be prevented, and the reduction in emergency unloading occurrence reduces the number of collisions between the head and the ramp, so that the head may have a prolonged life and the disk drive device may have improved reliability as an HDD.

The present invention recited in claim 7 features, in the recording and reproducing device recited in any one of claims 1 to 4, that the engine start detecting means outputs a signal which becomes validated by sending an output of a tachometer of the engine. The present invention recited in claim 8 features, in the recording and reproducing device recited in any one of claims 1 to 4, that the engine start detecting

means outputs a signal which becomes validated by sensing the vibration of the engine inside and outside the vehicle. Furthermore, the present invention recited in claim 9 features, in the recording and reproducing device as recited in any one of claims 1 to 4, that the engine start detecting means outputs a signal which becomes validated by sending an engine sound.

The present invention recited in claim 10 features, in the information recording and reproducing device as recited in any one of claims 1 to 4, that the engine start detecting means outputs a signal which becomes validated by sensing the traveling of the vehicle based on a vehicle speed pulse. The present invention recited in claim 11 features, in the information recording and reproducing device as recited in any one of claims 1 to 4, that the engine start detecting means outputs a signal which becomes validated by sensing the traveling of the vehicle using a gyro sensor. Furthermore, the present invention recited in claim 12 features, in the recording and reproducing device as recited in any one of claims 1 to 4, that the engine start detecting means outputs a signal which becomes validated by sensing the operation position of a parking brake.

The present invention recited in claim 13 features, in the information recording and reproducing device as recited in any one of claims 1 to 4, that the engine start detecting means outputs a signal which becomes validated by sensing an operation of a generator in the vehicle. The present invention recited in claim 14 features, in the recording and reproducing device as recited in any one of claims 1 to 4, that the engine start detecting means outputs a signal which becomes validated by sensing the activation of a starter-motor.

With this feature, the engine start can be detected based on the outputs of various sensors or by detecting the traveling of the vehicle, and emergency unloading at the start of the engine can be prevented by activating the HDD or allowing the head to move after the detection. As a result, emergency unloading at the start of the engine can be prevented, and the reduction in the emergency unloading occurrence reduces the number of collisions between the head and the ramp. Therefore, the head may have a prolonged life and the disk drive device may achieve improved reliability as an HDD.

The present invention recited in claim 15 features, in the recording and reproducing device as recited in any one of claims 10 to 14, that map information in the previous off state of the engine is backed up in a memory. The information is displayed on a screen in response to detection of a power supply being provided to the second power supply line. Thus, a map is displayed as the driver waits for the HDD to be

driven, and therefore the driver may be relieved from vexation during the waiting.

[Embodiment of the Invention]

Fig. 1 is a block diagram showing the configuration of a car navigation system provided with a recording and reproducing device according to the present invention. Herein, an HDD is used rather than a DVD as a map information storing part for a car navigation system by way of illustration. Note that while the present invention is not limited to the car navigation system, but also applicable to anything provided with an HDD in audio product for vehicle, the car navigation will be described as one embodiment. The recording and reproducing device according to the present invention includes a host CPU 11 as a main feature of control, a ROM 12, a RAM 13, a timer LSI (14), a hard disk drive (HDD) 15, a sensor 16, a GPS receiver 17, an interface 18, an input device 19, a display 20, a display controller 21, a display memory 22, a voice sound processing circuit 23, a speaker 24, a power supply circuit for vehicle 25, a hard disk controller HDC 26, and a backup RAM 27.

The host CPU 11 achieves general control of navigation such as searching the location of a destination and directing a route based on programs stored in the ROM 12 and the RAM 13, and also controls units 12, 13, 14, 27, 19, 23, 18, 26 and 21 connected to a system bus 10. A timer LSI 14 has its time count value set in a programmable manner by the host CPU 11, and issues an interrupt at time up to let the interrupt processing routine to take over the processing. Here, the driving timing of the HDD after the start of the engine is specified.

The HDD 15 is provided with a measure to prevent emergency unloading according to the present invention, and is connected with the system bus 10 through the HDC 26. The HDC 26 carries out format control of a magnetic disk mounted to the HDD 15, and also serves as a host interface and an HDD interface. The sensor 16 denotes a group of sensors required for autonomous traveling as a car navigation system, and for example includes a vehicle speed sensor and a gyro sensor. The sensor 16 is connected with the system bus 10 through the interface 18. The interface 18 is supplied with the output of the GPS receiver 17, and hybrid traveling control based on the GPS-measured position and autonomous traveling is carried out.

The display 20 includes a liquid crystal display monitor and a processing content such as map information written by the host CPU 11 in the display memory 22 is read by a display controller 21 for display. According to the present invention, during the period between the supply of ACC power supply and the activation of the HDD or for a while after the activation, map information representing the position of the vehicle itself at the previous engine termination which has

been written in the backup RAM 27 is displayed.

The input device 19 is a remote control device or console used as a GUI for inputting commands or communication between the navigation system and the display 20. The voice sound processing circuit 23 serves as a GUI by emitting a voice sound guide or receiving an input voice sound for communication with the navigation system. The voice sound guide is output through the speaker 24. A power supply circuit 25 for vehicle includes a normal power supply line (a) and an ACC power supply line (b) as described above.

Fig. 2 is a diagram showing in detail the configuration of the HDD 15 and the power supply circuit 25 in Fig. 1 and an engine start detecting device 30 for detecting the start of the engine. As shown, the power supply circuit 25 for vehicle includes two power supply lines, a normal power supply line (a) and an ACC power supply line (b).

The HDD 15 includes an internal CPU 152 as a main feature, a host interface circuit 151, a program memory 153, a data memory 154, an HDD interface circuit 155, an R/W (reading/writing) circuit 156, a head driving control circuit 157, a spindle motor control circuit 158, a magnetic head 51, a voice coil motor (VCM) 160, and a spindle motor 161.

The above described host interface circuit 5, the internal CPU 152, the program memory 153, the data memory 154, and the HDD interface circuit 155 are connected in common to the HDD system bus 150.

The internal CPU 152 receives a command (such as Seek, Read/Write) from the host CPU 11 in Fig. 1 through the host interface 151, and carries out the command control through the HDD interface circuit 155 according to a program stored in the program memory 153. Data read/written from/to a magnetic disk through the magnetic head is controlled by the R/W circuit 156, while the VCM motor 160 is driven under the control of the head driving control circuit 157. The spindle motor 161 is driven under the control of the spindle motor control circuit 158. Note that counter electromotive force generated by the inertial rotation of the spindle motor when the power supply is off is supplied from the spindle motor 161 to the head driving control circuit 157 through a line 170.

The engine start detecting device 30 includes a voltage value monitoring circuit 301, a threshold setting circuit 302, an engine start detecting circuit 303, and a group of sensors 304. The voltage value monitoring circuit 301 monitors the voltage values on the power supply lines 251 and 252 supplied from the two power supplies described above, and notifies the engine start detecting circuit 303 of the values. A threshold value to detect a momentary shutoff is set at the threshold setting circuit 304, and the engine start circuit is notified of the value. The engine start detecting circuit 303 obtains voltage value data from the voltage value monitoring circuit

301 and the threshold setting circuit 302 and then supplies an activation signal to the HDD in response to a detected engine start timing according to the process as will be described.

The engine start detecting circuit 303 is connected with the group of sensors 304 as an option. In this case, a signal to trigger detection of the engine start timing must be received and internal program-wise determination is necessary without the voltage value monitoring operation as described above. Therefore, program logics by microcomputers or the like are used for monitoring and control. In this case, as the group of sensors 304, a tachometer, a vibration sensor, a starter-motor, a generator and the like would thus be necessary in addition to the sensor 16 provided as part of the car navigation system. These will be detailed.

The activation timing of the HDD according to the present invention will now be described. According to the embodiment, the start of the engine is detected, so that after a momentary shutoff, the activation of the HDD is controlled and emergency unloading at the start of the engine is prevented. As the part for detecting the start of the engine, the case of monitoring the voltage values on the normal power supply line 251 and the ACC power supply line 252 will be described by way of illustration.

Fig. 3 is a timing charts for use in illustration of the timing of detecting the start of the engine using the engine start detecting device 30. In Fig. 3, (a) shows the voltage waveform at the normal power supply line 251, while (b) shows the voltage waveform at the ACC power supply line 252. SL (threshold value) is a prescribed voltage value, 9V for example according to the embodiment. This value is set so that the voltage value at a momentary shutoff caused at the vehicle is lower than SL.

The driver inserts the engine key in the LOCK position to release the lock, and turns the key to the ACC position (I). Thus, the ACC power supply rises for example to 12V, and the key is then turned to the START position (II) through the ON position (II), which starts the starter-motor and voltage rises both on the normal power supply line 251 and the ACC power supply line 252. After a prescribed time period, the engine starts (IV), and the ACC power supply line 252 and the normal power supply line 251 rise gain to the original voltage value 12V, and a steady state is regained. Note that the time period between the ACC position, the start of the starter-motor and the start of the engine is random. Here, in order to make sure that the emergency unloading is avoided, the engine start position (the position IV) needs only be detected, and then an activation instruction may be given to the HDD. Therefore, the engine start detecting circuit 303 monitors if the voltage value on the ACC power supply line 252 exceeds the level of a prescribed threshold value (SL) through

the voltage value monitoring circuit 301. If it exceeds the threshold value (SL), the engine key has come to the position of ACC, and it is then monitored whether or not the engine is provided with a power supply. More specifically, the engine start detecting circuit 303 monitors the voltage value on the normal power supply line 251 through the voltage value monitoring circuit 301. It is monitored whether or not the voltage value on the normal power supply line 251 is lower than the prescribed threshold value (SL). Here, it may be possible to monitor whether or not the two power supply lines, the normal power supply line 251 and the ACC power supply line 252 are both below the prescribed threshold value (SL), while monitoring only the ACC power supply line 252 does not allow the start of the engine to be surely detected. This is because the engine key may be returned to the position of the key LOCK from the ACC position. Therefore, after the normal power supply line 251 becomes higher than the prescribed threshold value (SL), the normal power supply line 251 or the two power supply lines, the normal power supply line 251 and the ACC power supply line 252 must be monitored.

When the voltage value on the power supply line is lower than the prescribed threshold value (SL), the engine key has come to the ST position (III) through the ACC position (I) and the ON position (II), it is monitored whether the engine starts or not. More specifically, the engine start detecting circuit 303 monitors whether the voltage value on the normal power supply line 251 exceeds the prescribed threshold value (SL) through the voltage value monitoring circuit 301. If it exceeds the prescribed threshold value (SL), the engine has started, and therefore an instruction signal corresponding to the start of the engine is supplied to the HDD 15. Note that in the detection of the start of the engine, it can be monitored whether or not the two power supply lines, the normal power supply line 251 and the ACC power supply line 252 are higher than the prescribed threshold value (SL).

The HDD 15 receives the instruction signal at the internal CPU 152, and the magnetic head 51 is allowed to move in response to an instruction from the internal CPU 152. As described above, according to the embodiment, voltage values of the two power supply lines, the normal power supply line 251 and the ACC power supply line 252 may be monitored to surely detect the start of the engine, and then the magnetic head 51 of the HDD 15 is allowed to move.

Therefore, the emergency unloading by the momentary shutoff caused at the start of the engine can be avoided, and the collision between the magnetic head 51 and the ramp 55 at the start of the engine can be prevented. Note that in the above described embodiment, the magnetic head 51 is allowed to move after the start of the engine, while the power supply for the HDD may be kept off before the start of the engine, and

the HDD may be turned on after the start of the engine is detected by the above described part. A method of detecting the start of the engine using power supply lines connected to the key switch will be now described.

Fig. 4 is a diagram of the configuration in Fig. 2 having additionally provided power supply lines connected to the key switch 40. In this figure, the members denoted by the same reference characters as those in Fig. 2 achieve the same operation, and therefore will not be described.

As shown in Fig. 4, the key switch 40 is connected with a normal power supply line 251 and an ACC power supply line 252, a power supply line 253, and a power supply line 254. The normal power supply line 251, the ACC power supply line 252, and the power supply line 253 indicate voltage values when the engine key is at the LOCK position, the ACC position, the IG position, respectively. The power supply line 254 indicates a voltage value when the engine is started.

Fig. 5 is a timing chart for use in illustration of the timing of detecting the start of the engine by the engine start detecting device 30. In Fig. 5, (a) represents the voltage waveforms on the normal power supply line 251, (b) represents the ACC power supply line 252, (c) represents the IG power supply line 253 and (d) represents the ST power supply line 254, respectively. The SL (threshold value) is a prescribed voltage value, 9V for example according to the embodiment. This is set so that the voltage value at the momentary shutoff in a vehicle is lower than the value SL.

The driver inserts the engine key to the LOCK position to release the lock, then turns the engine key to the ACC position (I). This causes the ACC power supply to be on and raised to for example 12V. Then, when the engine key is turned to the ON position (II), the IG power supply is raised and a power supply voltage is supplied for example to the power window or the like. Then, when the engine key is turned to the ST position (III), the starter-motor starts and the voltages on the normal power supply line 251 and the ACC power supply line 252 both fall, and the ST power supply is raised. After a prescribed time period, the engine starts (IV), and the ACC power supply line 252 and the normal power supply line 251 are raised to the original voltage values, and the ST power supply falls, and a steady state is regained. Note that the time period between the ACC position, the starter-motor start and the start of the engine is random. Here, in order to surely avoid the emergency unloading, the start of the engine (the position of IV) needs only be detected and then an activation instruction may be applied to the HDD. Therefore, the engine start detecting circuit 303 monitors whether or not the value on the ACC power supply line 252 or the IG line 253 exceeds the prescribed threshold value (SL) through the voltage value monitoring circuit 301. A value beyond the

threshold value (SL) indicates that the engine key is at the ACC or IG position, and therefore it is then monitored whether or not the engine is provided with a power supply. More specifically, the engine start detecting circuit 303 monitors the voltage value on the normal power supply line 251 through the voltage value monitoring circuit 301 and determines if the voltage value on the normal power supply line 251 is lower than the prescribed threshold value (SL). Here, it would be possible to monitor whether the two power supply lines, i.e., the normal power supply line 251 and the ACC power supply line 252 are both lower than the prescribed threshold value (SL), while monitoring only the ACC power supply line 252 does not allow the engine start to be surely detected. This is because the engine key could be returned from the ACC position to the key LOCK position. Therefore, after the value on the normal power supply line 251 exceeds the prescribed threshold value (SL), the normal power supply line 251 or the two power supply lines, i.e., the normal power supply line 251 and the ACC power supply line 252 must be monitored.

Whether or not a power supply is provided for starting the engine may be determined based on the voltage value on the ST power supply line 254. More specifically, the ST power supply line 254 rises only when a power supply is provided for starting the engine, and therefore the voltage value can be monitored for the purpose.

When the value on the normal power supply line 251 or the values on the normal power supply line 251 and the ACC power supply line 252 are lower than the prescribed threshold value (SL), the engine key has come to the ST position (III) through the ACC position (I) and the ON position (II). Then, it is monitored if the engine starts. More specifically, the engine start detecting circuit 303 monitors the voltage value on the normal power supply line 251 through the voltage value monitoring circuit 301, and determines whether or not the voltage value on the normal power supply line 251 exceeds the prescribed threshold value (SL). If the voltage value exceeds the threshold value (SL), the engine has started, and therefore an engine start instruction signal is provided to the HDD 15. The engine start may be detected by monitoring whether the values on the two power supply lines, i.e., the normal power supply line 251 and the ACC power supply line 252 exceed the prescribed threshold value (SL). Alternatively, it can be monitored whether the value on the ST power supply line 254 is lower than the prescribed threshold value (SL).

The HDD 15 receives the instruction signal at the internal CPU 152 and then the magnetic head is allowed to move in response to an instruction from the internal CPU 152.

As described above, according to the embodiment, the voltage values at the four power supply lines, i.e., the normal power supply line 251, the ACC power supply line 252,

the IG power supply line 253, and the ST power supply line 254 are monitored to surely detect the start of the engine, and then the magnetic head 51 of the HDD 15 is allowed to move.

Therefore, emergency unloading by a momentary shutoff caused at the start of the engine can be avoided, and the collision between the magnetic head 51 and the ramp 55 at the start of the engine can be prevented. Note that in the above embodiment, a control method to allow the magnetic head 51 to move after the engine start, while the HDD can be kept off before the engine start and then turned on after the start of the engine is detected by the above described part.

The foregoing description is related to the detection of the engine start by monitoring any of voltage values at the four power supply lines 251 to 254 using the engine start detecting device 30. Meanwhile, the engine start can be detected based on any of the outputs of the following sensors 304.

Detection based on the output of the tachometer

The engine start detecting device 30 monitors the engine revolution through the engine start detecting circuit (microcomputer) 303 and obtains information from the tachometer through an A/D converting circuit which is not shown. Then, the engine start detecting device 30 determines that the engine has started if the continuous engine revolution has been detected for a certain period.

Sensing using an engine sound detector

Engine sounds are detected inside and outside the vehicle using a microphone and the like, the detected sound is subjected to frequency conversion at the engine start detecting circuit (microcomputer) 303, and the engine start is determined if a frequency spectrum representing the engine revolution is detected for a prescribed time period or longer.

Sensing based on vibration information

Vibration information is sensed using a vibration sensor. The engine start detecting circuit (microcomputer) 303 determines that the engine has started if the difference in the vibration information between the engine inactive state and the engine active state is detected for a prescribed time period or longer.

Detecting based on the output of the generator

The engine start detecting circuit (microcomputer) 303 obtains information about whether or not the generator operates, and determines the engine start based on the operation for a prescribed time period or longer. The engine start detecting circuit (microcomputer) 303 corresponding to a hybrid car obtains information about starter-motor activation and detects the engine start.

Note that the foregoing description is related to the detection of the engine start using the various sensor outputs followed by the activation of the HDD. Meanwhile, the HDD may

be activated in a timing after the vehicle starts moving. In this case, the sensor 16 provided as a car navigation system for example may be used to detect the traveling of the vehicle. According to one method, a vehicle speed pulse may be detected. The generation state of the vehicle speed pulse and the timing of activating the HDD are represented in the timing chart in Fig. 6.

In this figure, once the engine key has been inserted followed by the process from (I) to (IV), the engine starts and the vehicle starts moving (V), and an output signal P for the vehicle speed pulse is generated. The pulse signal may be detected by a traveling detection circuit which is not shown and the traveling of the vehicle is detected. Based on the detection signal, the HDD is activated.

Another method of detecting the traveling state of the vehicle is based on the output of a gyro sensor, the OFF output of a parking brake and the like.

As described above, according to the embodiment, based on the output signals of the various sensors which can be used for detecting the traveling state, the traveling of the vehicle is surely detected, and then the magnetic head 51 of the HDD 15 is allowed to move.

As a result, emergency unloading by a momentary shutoff caused at the start of the engine can be avoided, and the collision between the magnetic head 51 and the ramp 55 at the start of the engine can be prevented. Note that in the embodiment, the magnetic head 51 is allowed to move after the vehicle starts moving, while the HDD may be kept off before the vehicle starts moving and turned on after the vehicle starts moving by the above described part.

As in the foregoing, according to the embodiment, the HDD is activated after the vehicle engine starts or after the vehicle starts moving, and therefore emergency unloading at the start of the engine can surely be avoided. However, since map data is not displayed on the monitor screen until the HDD is activated, the user might feel insecure. Therefore, in the navigation system according to the embodiment, during the period between the ACC ON to the start of the engine, a map stored in the backup RAM 27 and indicating the position of the vehicle the last time the engine has stopped is preferably displayed. Besides the navigation system, in an HDD integrated music information reproducing apparatus for vehicle, information (such as index information) to specify music information performed at the previous engine interruption which has been stored in the backup RAM 27 is preferably displayed.

As described above, according to the present invention, in the HDD for vehicle, the HDD is activated or the head is driven after the engine start is detected or after the vehicle starts traveling. Therefore, emergency unloading can be

prevented at the start of the engine. The reduction in emergency unloading occurrence can reduce the number of collisions between the head and the ramp, so that an information recording and reproducing device for vehicles having a head with a prolonged life and improved reliability as an HDD may be provided.

[Effect of the Invention]

According to the invention recited in claim 1, the information recording and reproducing device is driven after the start of the engine in the vehicle is detected by the engine start detecting means, and therefore emergency unloading at the start of the engine can be avoided. As a result, the reduction in emergency unloading occurrence can reduce the number of collisions between the head and the ramp, so that the head has a prolonged life and the information recording and reproducing device for vehicles may have improved reliability as an HDD.

According to the invention recited in claim 2, after an engine start in a vehicle is detected by the engine start detecting means, the movement of the head by the head driving means is allowed. Therefore, the HDD becomes accessible after the engine is activated, so that emergency unloading at the start of the engine can be prevented, and the reduction in emergency unloading occurrence reduces the number of collisions between the head and the ramp. As a result, the head may have a prolonged life and the disk drive device may have improved reliability as an HDD.

According to the invention recited in claim 3, claim 4, the head can surely be returned to the retreat position if the power supply is interrupted, and therefore the HDD including the head can be prevented from being critically damaged.

According to the invention recited in claim 5, claim 6, the engine start can be detected by monitoring the voltages, and the HDD is activated or the head is allowed to move after the detection. Therefore, emergency unloading at the start of the engine can be prevented, and the reduction in emergency unloading occurrence reduces the number of collisions between the head and the ramp. As a result, the head may have a prolonged life and the disk drive device may have improved reliability as an HDD.

According to the invention recited in claim 7 to claim 14, the engine start can be detected based on the various sensor outputs or by detecting the traveling of the vehicle. After the detection, the HDD is activated or the head is allowed to move, so that emergency unloading can be prevented at the start of the engine, and the reduction in emergency unloading occurrence reduces the number of collisions between the head and the ramp. As a result, the head may have a prolonged life and the disk drive device may have improved

reliability as an HDD.

According to the invention recited in claim 15, map information in the previous engine off state is backed up in a memory and the map information is displayed on the screen. Thus, a map is displayed as the driver waits for the HDD to be driven, and therefore the driver may be relieved from vexation during the waiting.

[Brief Description of the Drawing]

Fig. 1 is a block diagram of a car navigation system in which an information recording and reproducing device for vehicles according to the present invention is mounted.

Fig. 2 is a block diagram showing the detailed structure around the HDD, vehicle mounted power supply circuit in Fig. 1.

Fig. 3 is a timing charts cited for explaining an example of the operation of an engine start detecting device in Fig. 2.

Fig. 4 is a block diagram showing an embodiment in which each power supply line connected to a key switch is added to the embodiment shown in Fig. 2.

Fig 5. is timing charts cited for explaining the operation of the engine start detecting device shown in Fig. 4.

Fig. 6 is a diagram illustrating the relation between the generation state of a vehicle speed pulse and the activation of an HDD in a timing chart.

Fig. 7 is a plan view of the basic structure of a ramped loading type HDD.

Fig. 8 is a diagram cited for the explanation of the positional relation between the ramp and the head in Fig. 7.

Fig. 9 is a diagram showing a power supply line of a vehicle mounting audio product.

Fig. 10 is a timing chart cited for for explaining the operational sequence of the vehicle mounted power supply at the start of the engine.

[Brief Explanation of Reference Signs]

11... host CPU, 15... hard disc device (HDD), 16... sensor, 25... vehicle mounted power supply, 27... backup RAM, 30... engine start detecting device, 152... CPU built in HDD, 157... head drive control circuit, 161... spindle motor, 251... normal power supply line, 252... accessory (ACC) power supply line, 253... ignition (IG) power supply line, 254... starter (ST) power supply line, 301... voltage value detecting circuit, 302... threshold value setting circuit, 303... engine start detecting circuit, 304... various sensors

FIG.1

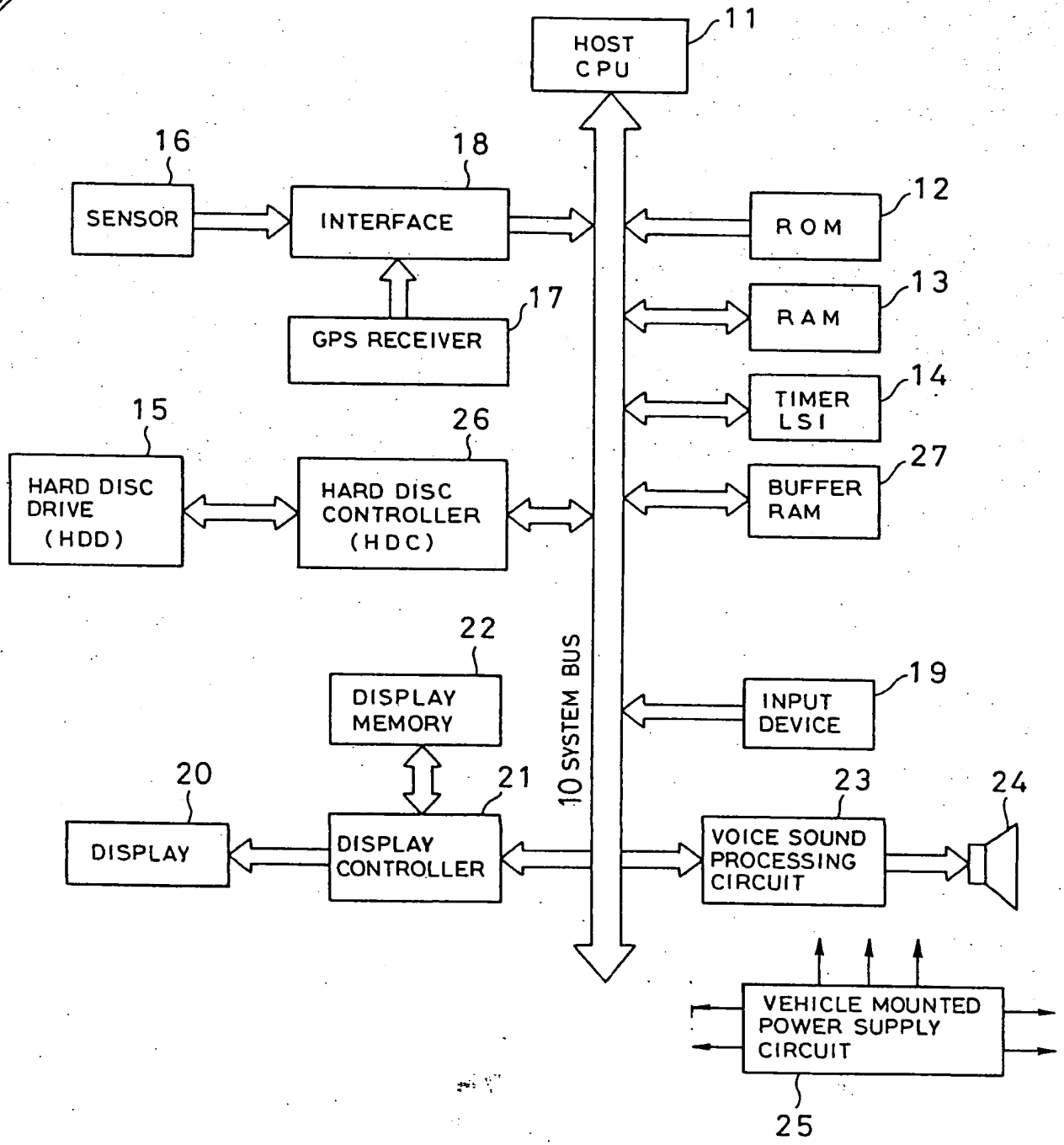
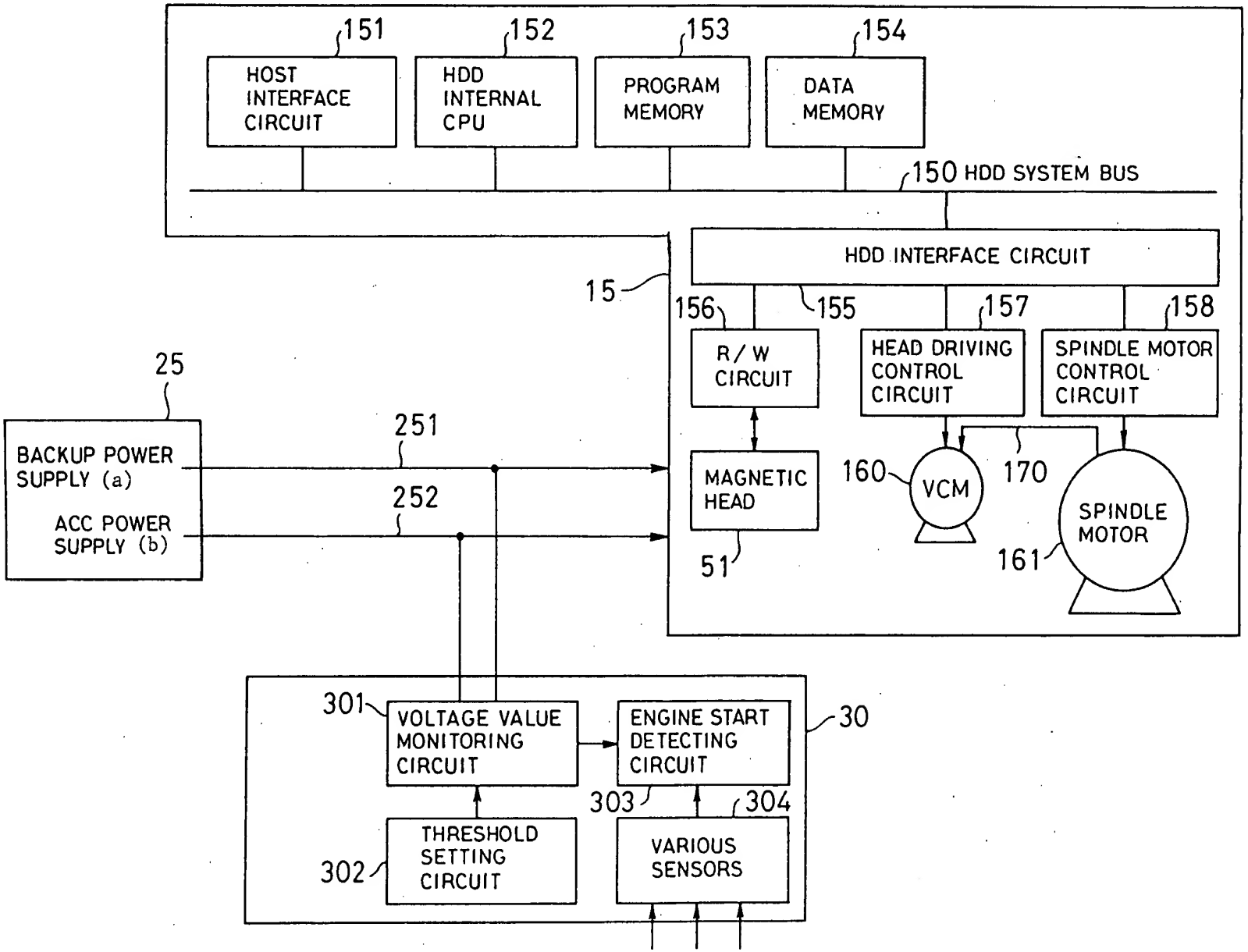


FIG.2



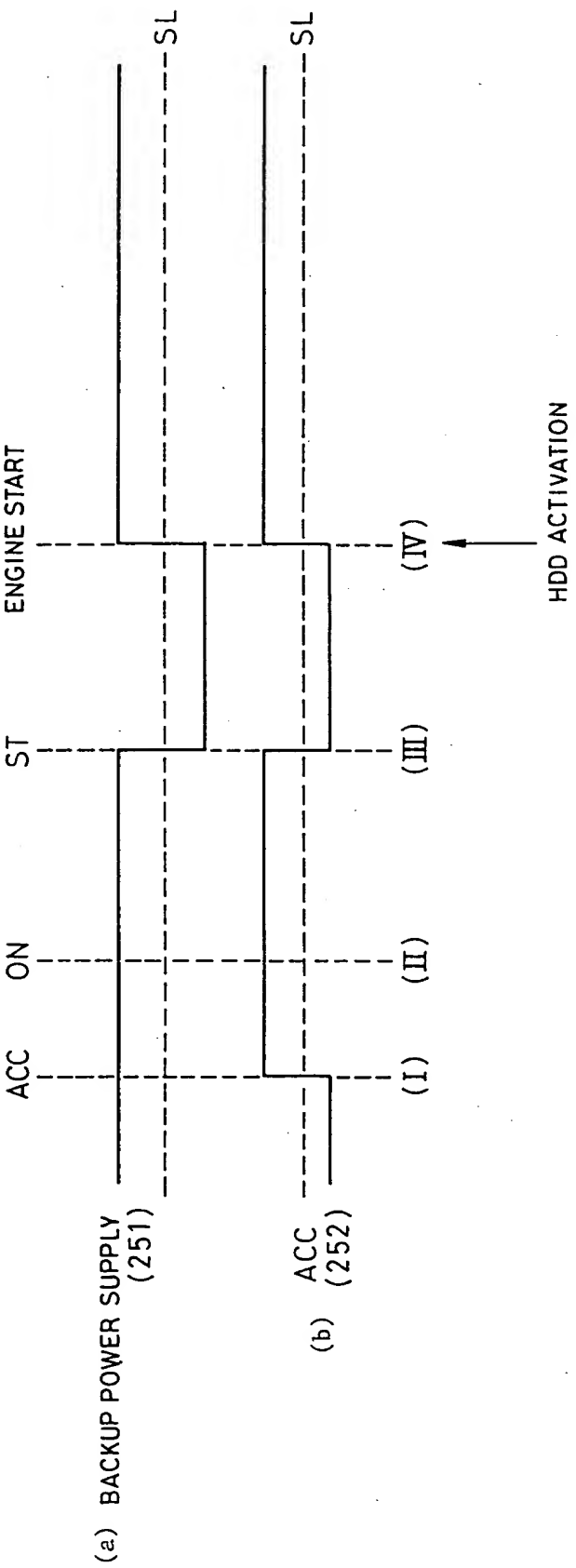
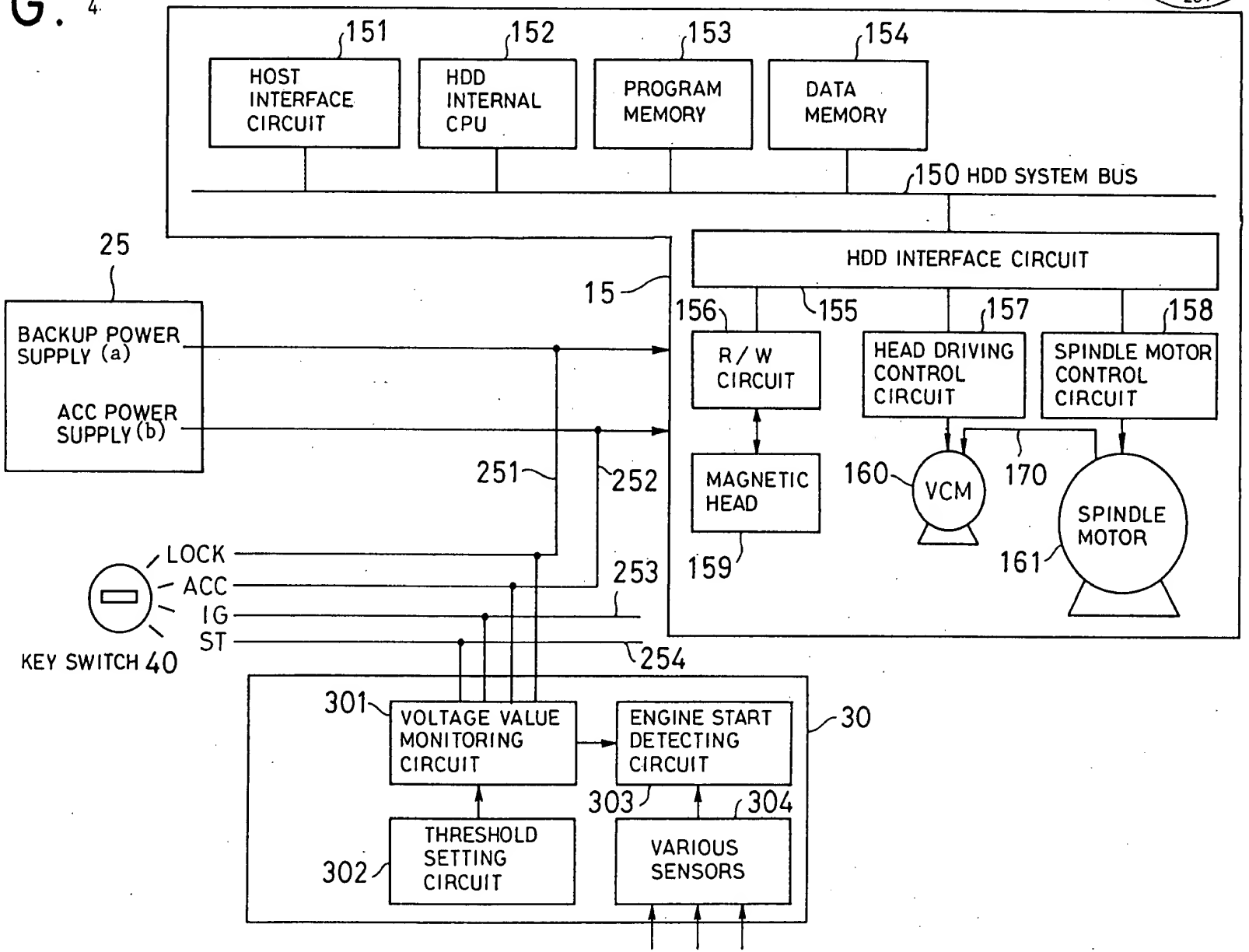


FIG.3

FIG. 4



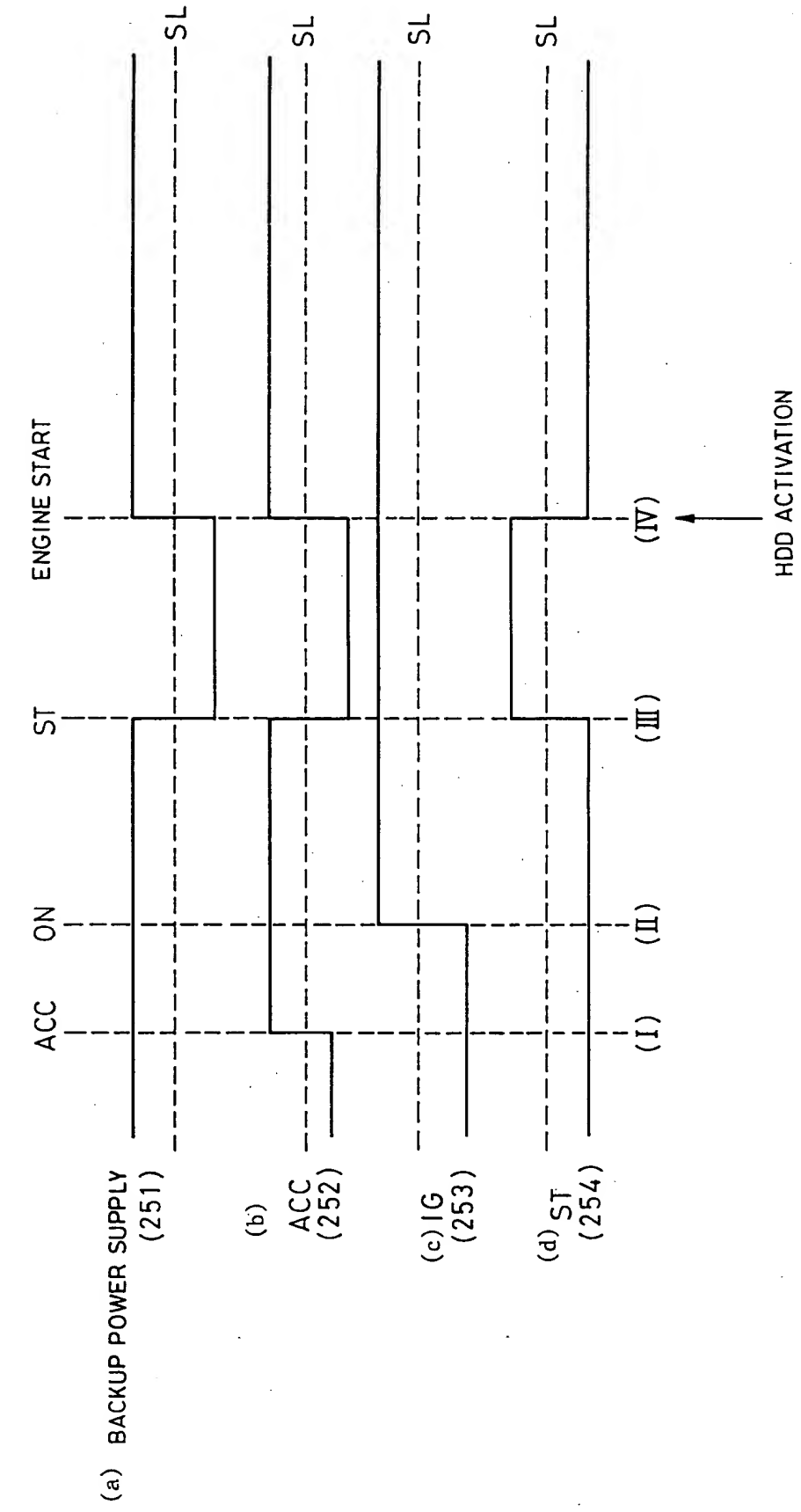


FIG.5

FIG. 6

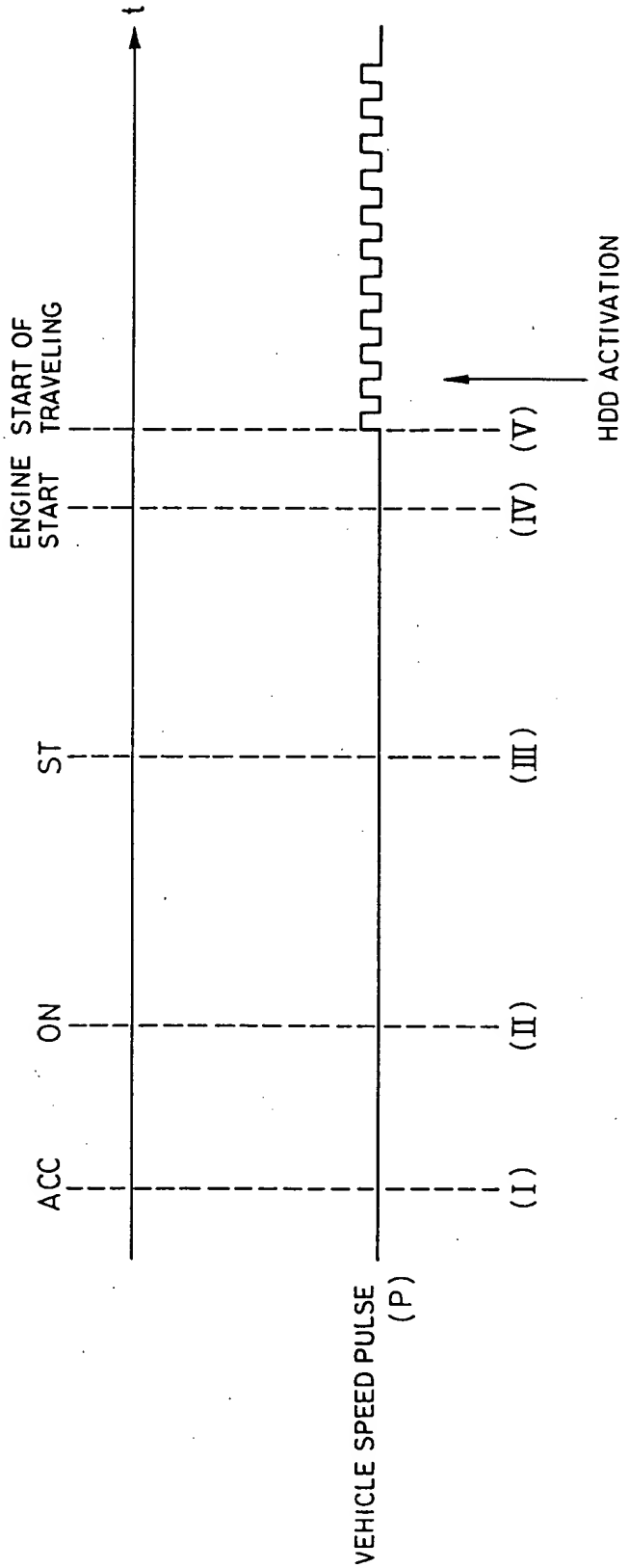


FIG. 7

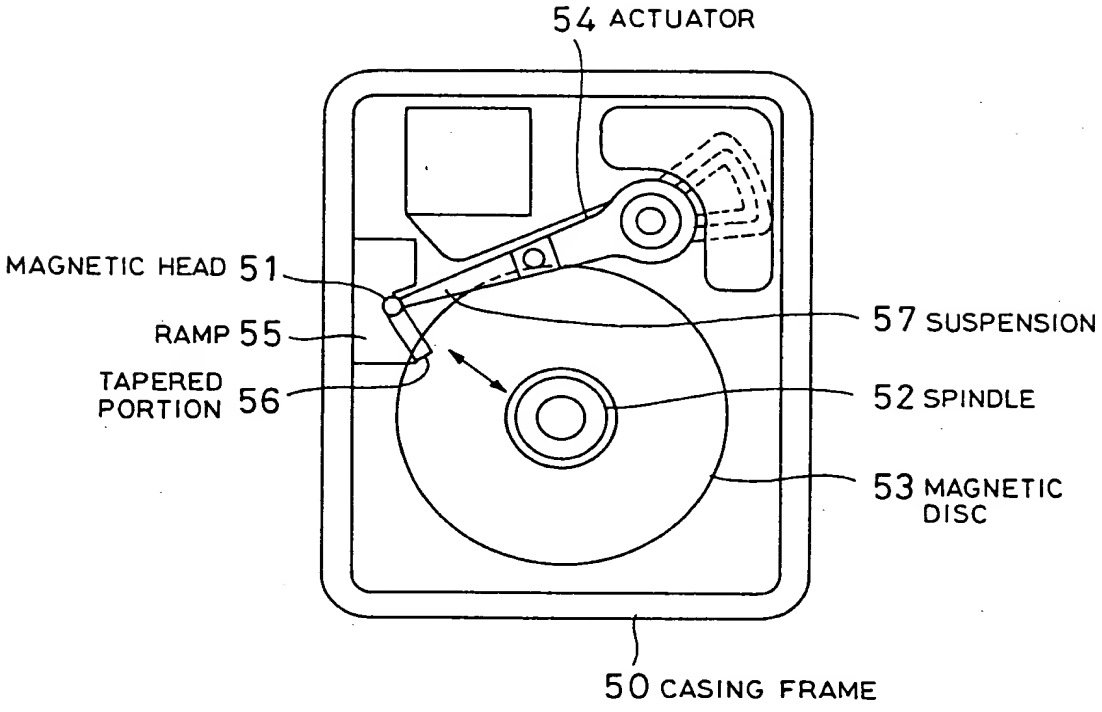


FIG. 8

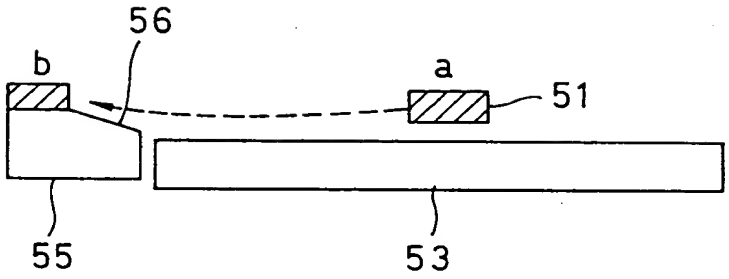
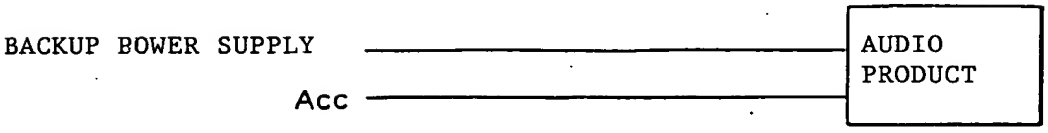


FIG.9



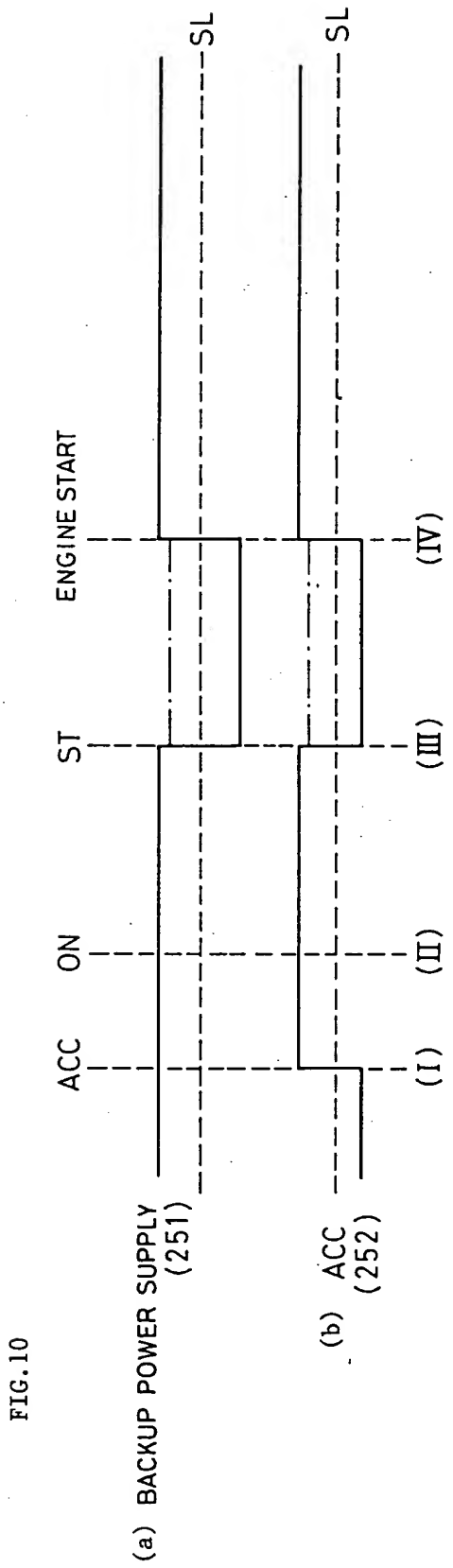


FIG.10

[Document Name] ABSTRACT

[Abstract]

[Object]

To prevent the occurrence of an emergency unloading at the start of the engine, so that a head's prolonged life is pursued and an improved of the reliability as an HDD is attained.

[Measure taken to attain the Object] The occurrence of an emergency unloading at the time of engine starting is avoided by performing the drive and control of an information recording and reproducing device (HDD 15) or allowing the movement of a magnetic head 51 by a head driving means (head drive control circuit 51) after an engine start in a vehicle is detected by an engine start detecting means (engine start detecting device 30). In order to detect the engine start, there are ways to monitor the voltage values on four power supply lines (251 to 254) for a vehicle power supply device 25 or the outputs of various sensors 304 such as a tachometer, a vibration detection sensor, an engine sound detection sensor, a vehicle speed pulse, a gyro sensor and a parking brake.
[Selected Drawing] Fig. 2